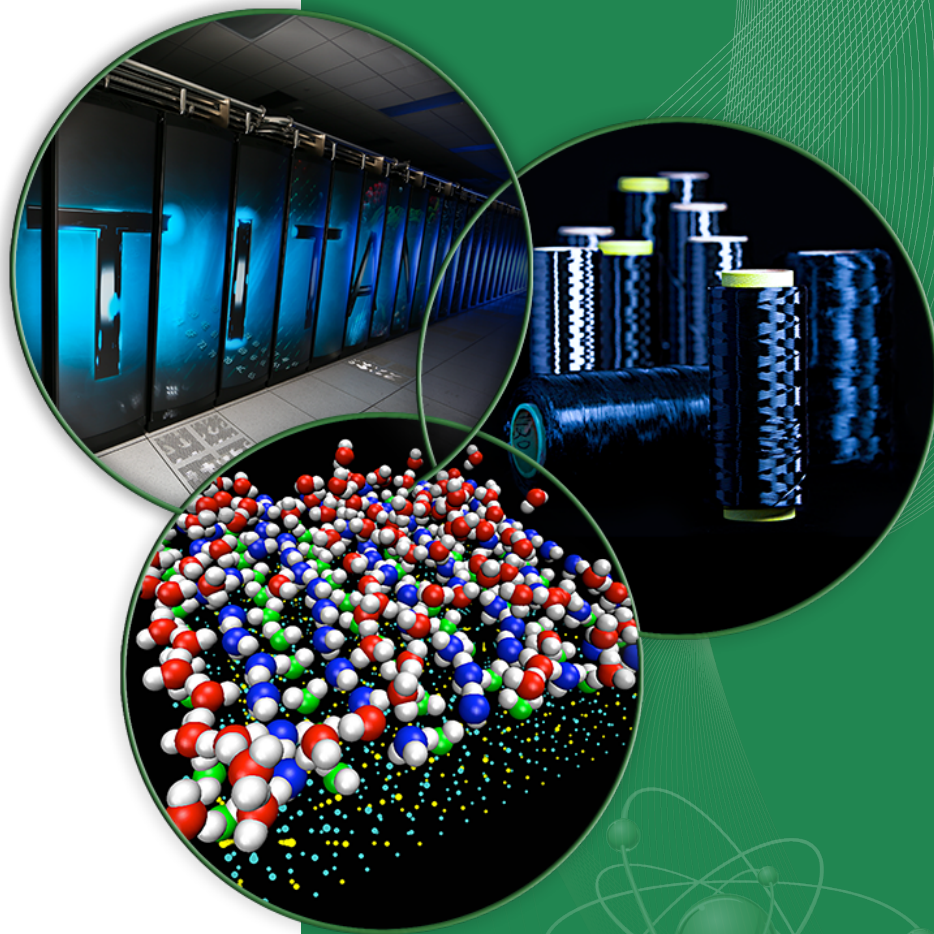


Status of the Development and Deployment of the NCSP Training and Education Courses for FY15

Douglas G. Bowen
Course Coordinator

NCSP Technical Program
Review Meeting
Sandia National Laboratory
March 17, 2016



Agenda

- Course objectives and offerings
- 2-week Hands-on course update
- 1-week Hands-on course update
- Course Statistics
- Logistical Improvements and Future Course Updates

US DOE NCSP T&E Mission

- The T&E program element will continue to identify, develop, and facilitate training needs and educational resources (including hands-on training with fissionable material systems) in areas where no suitable alternative exists
- Primary purpose
 - ...to maintain and enhance the technical abilities and knowledge of those who impact or are impacted directly by the practice of criticality safety
- This includes training and education of people entering the criticality safety discipline from related scientific fields and maintaining and enhancing competency levels of those already in the community

US DOE NCSP T&E Course Vision⁽¹⁾

- T&E Vision
 - This NCSP element will identify, develop, provide, and promote practical and excellent technical training and educational resources that help ensure competency in the art, science and implementation of nuclear criticality safety and is adaptable and responsive to the needs of those responsible for developing, implementing, and maintaining criticality safety.

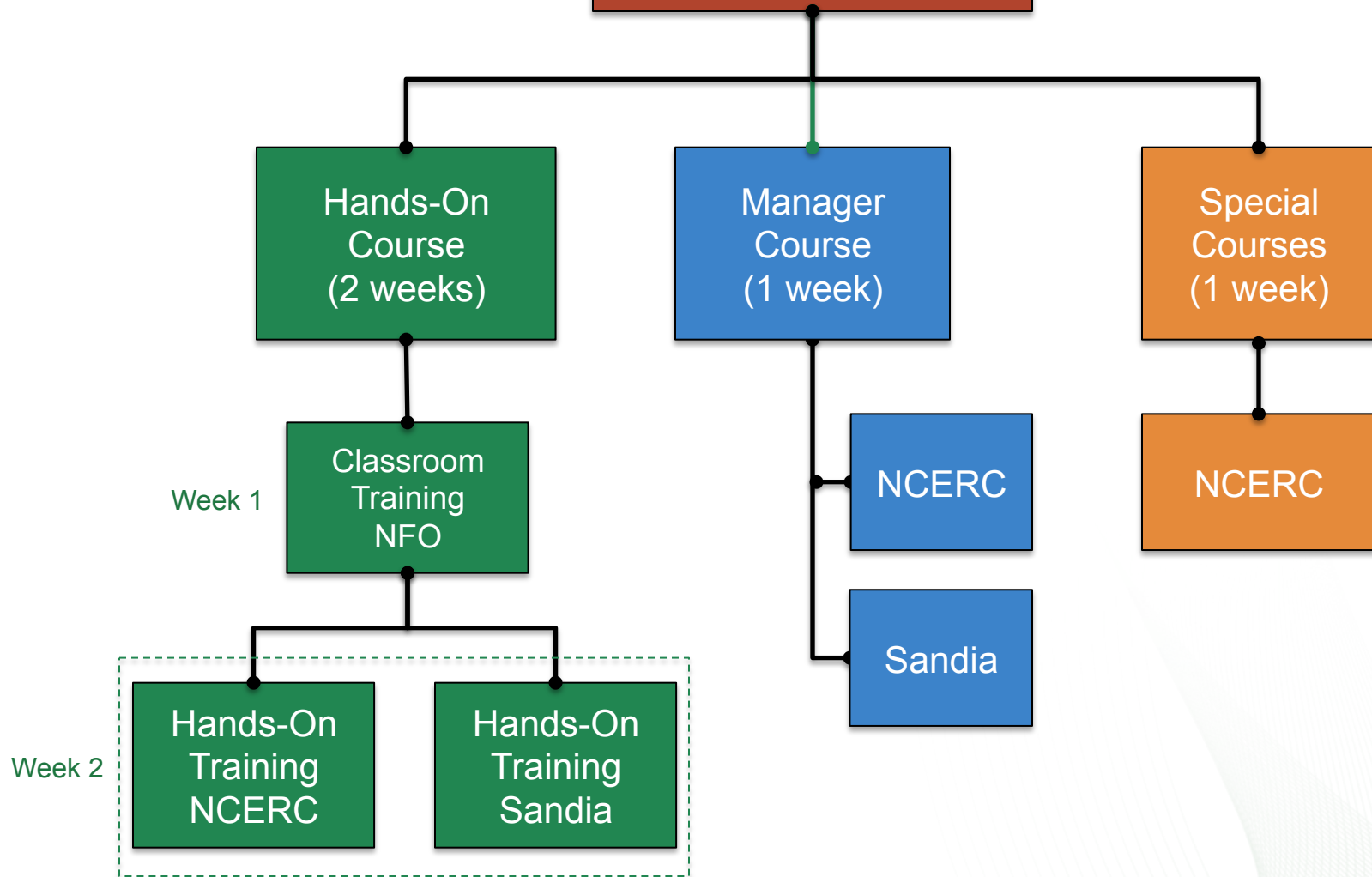
⁽¹⁾ *The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2009 – 2018*, (<http://ncsp.llnl.gov/NCSP-MV-COMPRESSED.pdf>)

T&E General Course Objectives*

- Provide a consistent level of DOE interpretation, understanding, awareness and applications regarding
 - DOE Orders, Guides, ANS Standards, Rules
 - Performance of Criticality Safety Evaluations
 - Hazards Analysis Methods and Implementation/maintenance of NCS Controls including precision and uncertainty of NDA and DA requirements
- Ensure versatility for cleared and un-cleared students
- Provide alternate/backup facility capabilities for hands-on training
- Provide experimental hands-on training addressing
 - Characteristics of Neutron Multiplying Systems
 - Discussion of
 - Reactor dynamics
 - Implications for the Safety of Fissionable Material Operations

* CSSG Tasking 2009-03, Recommendations for the Future DOE NCSP Training and Education Infrastructure Program

NCSP Training and Education Courses



2-week Hands-on Course – Week 1 Classroom Portion

Focus: NCS Evaluation Development

- DOE Requirements, National standards, and the DOE Nuclear Criticality Safety Program NCSP
- Process criticality accident lessons-learned
- NCS fundamentals
- ANSI/ANS-8 consensus standards
- Single unit and array hand calculation methods
- NCS evaluations and **evaluation exercise**
- Human factors and reliability principles for NCS evaluations
- NDA – interpretation and application of NDA methods and results to NCS evaluations
- Validation of Computational Methods
- Homework and quizzes assigned daily
- Students must pass the course with an overall grade of 80%
 - 70% Written Exam + 30% Participation Grade



June 2015 Class Photo



Feb. 2016 Class Photo

NCS Evaluation Exercise Augmentation for the NFO Portion of the 2-week Course

NCS Evaluation (NCSE) Exercise (~12.5 hours)

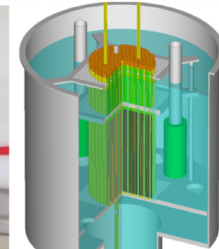
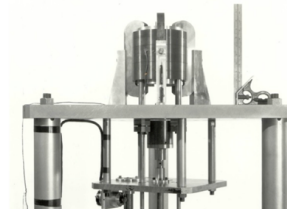
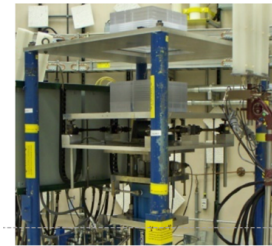
- NCSE Lecture 1 – Intro to normal conditions
 - Workshop 1 – Develop a process description and define normal conditions using a hypothetical process
- NCSE Lecture 2 – Intro to credible abnormal conditions
 - Workshop 2 – Determine the credible abnormal conditions for the hypothetical process
- NCSE Lecture 3 – Control selection
 - Workshop 3 – Develop controls for the hypothetical process
- Workshop 4 – Student presentations of control sets for the hypothetical process
- Workshop 5 – Review complete NCS evaluations for the hypothetical process and discuss as a class



2-week Hands-on Course – Week 2 Hands-On Portion

Focus: NCS Evaluation Development

- Overview of Sandia and NCERC facilities and assemblies
- Overview of the experiment procedures and methodology
- Neutron dynamics fundamentals and subcritical multiplication
- Nuclear instrumentation
- ANSI/ANS-1 *Conduct of Critical Experiments*
- Lessons learned from experimental criticality accidents
- Subcritical and critical experiments
 - NCERC – operations with Planet, Flattop, Godiva IV, BeRP Ball, Np-237 Sphere, and Training Assembly for Criticality Safety (TACS)
 - Sandia – Seven percent critical experiment (7uPCX), Annular Core Research Reactor Core (ACRR) burst
- Critical experiments and the International Criticality Safety Benchmark Evaluation Project (ICSBEP) handbook
- Students must pass the course with an overall grade of 80%
 - 70% Written Exam + 30% Participation Grade



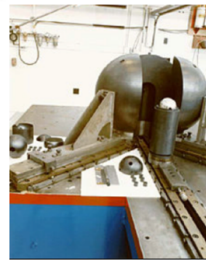
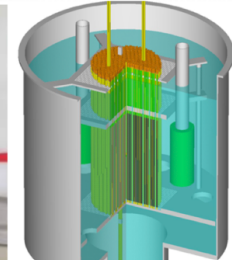
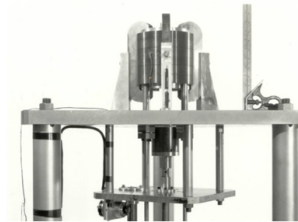
Aug. 2015 Class Photo



1-week Manager Course

Focus: Understanding of the student's role in an NCS Program

- DOE Requirements, National standards, and the DOE NCSP
- Overview of Sandia and NCERC facilities and assemblies
 - Overview of the experiment procedures and methodology
- Neutron dynamics fundamentals and subcritical multiplication
- Nuclear instrumentation; Conduct of operations
- ANSI/ANS-1 & 8 Consensus Standards
- NCS Evaluations
- Lessons learned from criticality accidents
- Subcritical and critical experiments
 - NCERC – Ops with Planet, Flattop, Godiva IV, BeRP Ball, Np-237 Sphere, and Training Assembly for Criticality Safety (TACS)
 - Sandia – Seven percent critical experiment (7uPCX), Annular Core Research Reactor Core (ACRR) burst
- Students must pass the course with an overall grade of 80%
 - 70% Written Exam + 30% Participation Grade



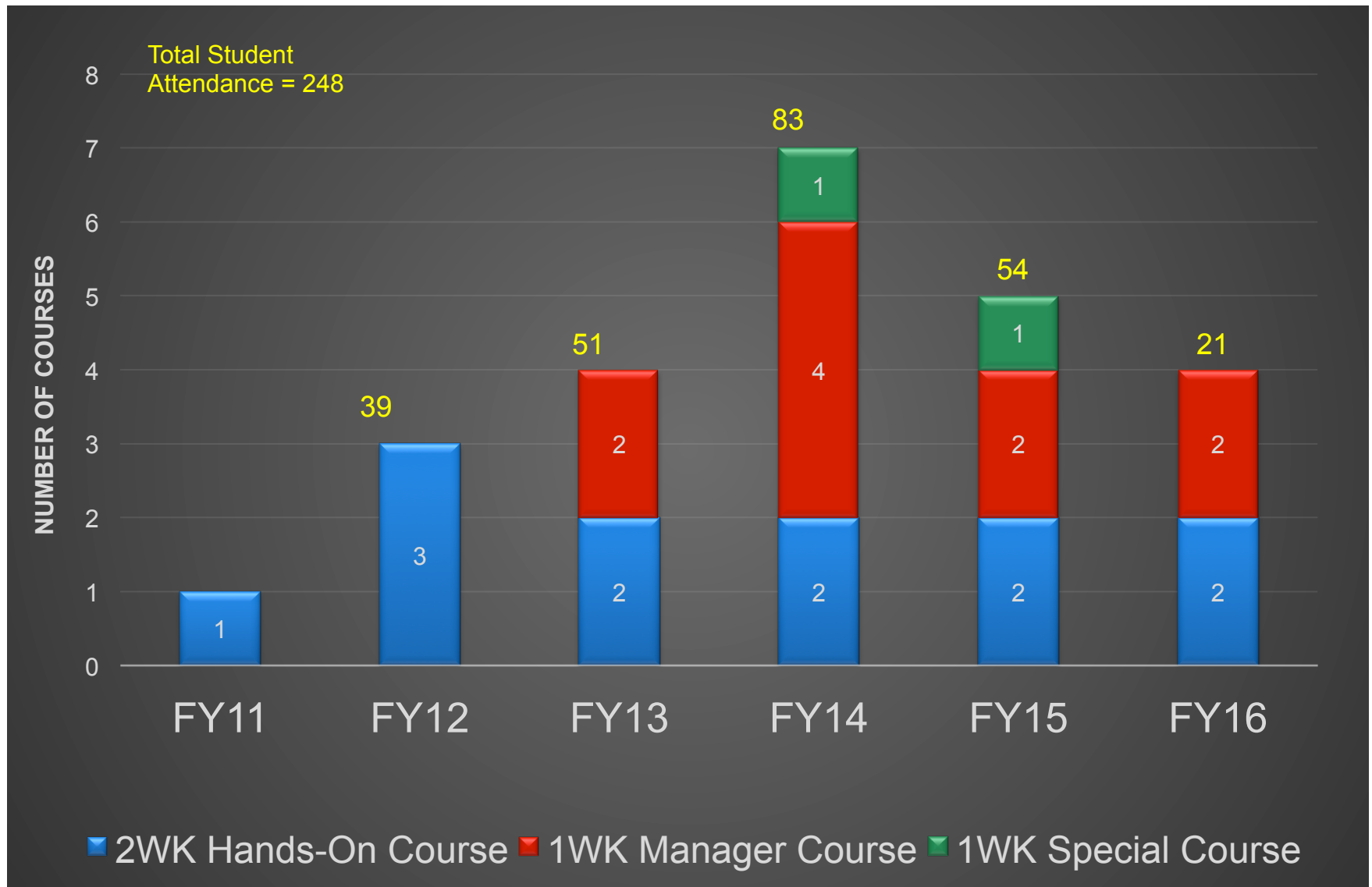
Completion Certificates

- For the hands-on course, students must attend both classroom and one of the hands-on weeks
- Must demonstrate comprehension by passing closed-book exams
 - 80% or better for both weeks to receive a certificate of completion and
 - 70% test, 30% participation during the hands-on week
- If failed, may attend the course again (with approval)
- Discontinuous attendance allowed on a case by case basis (to be completed within 1 year)
 - No certificate until both completed successfully

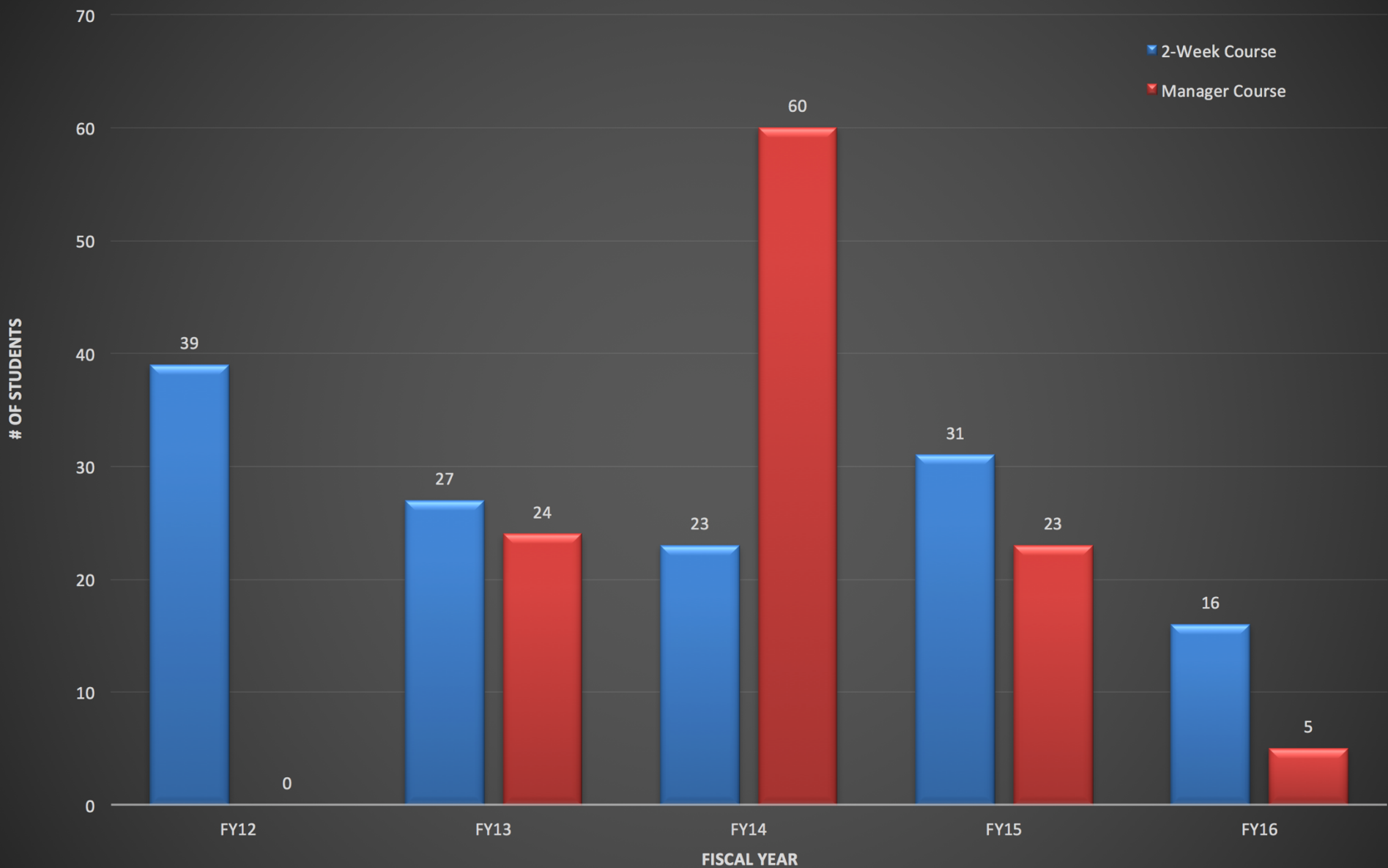


Course Statistics

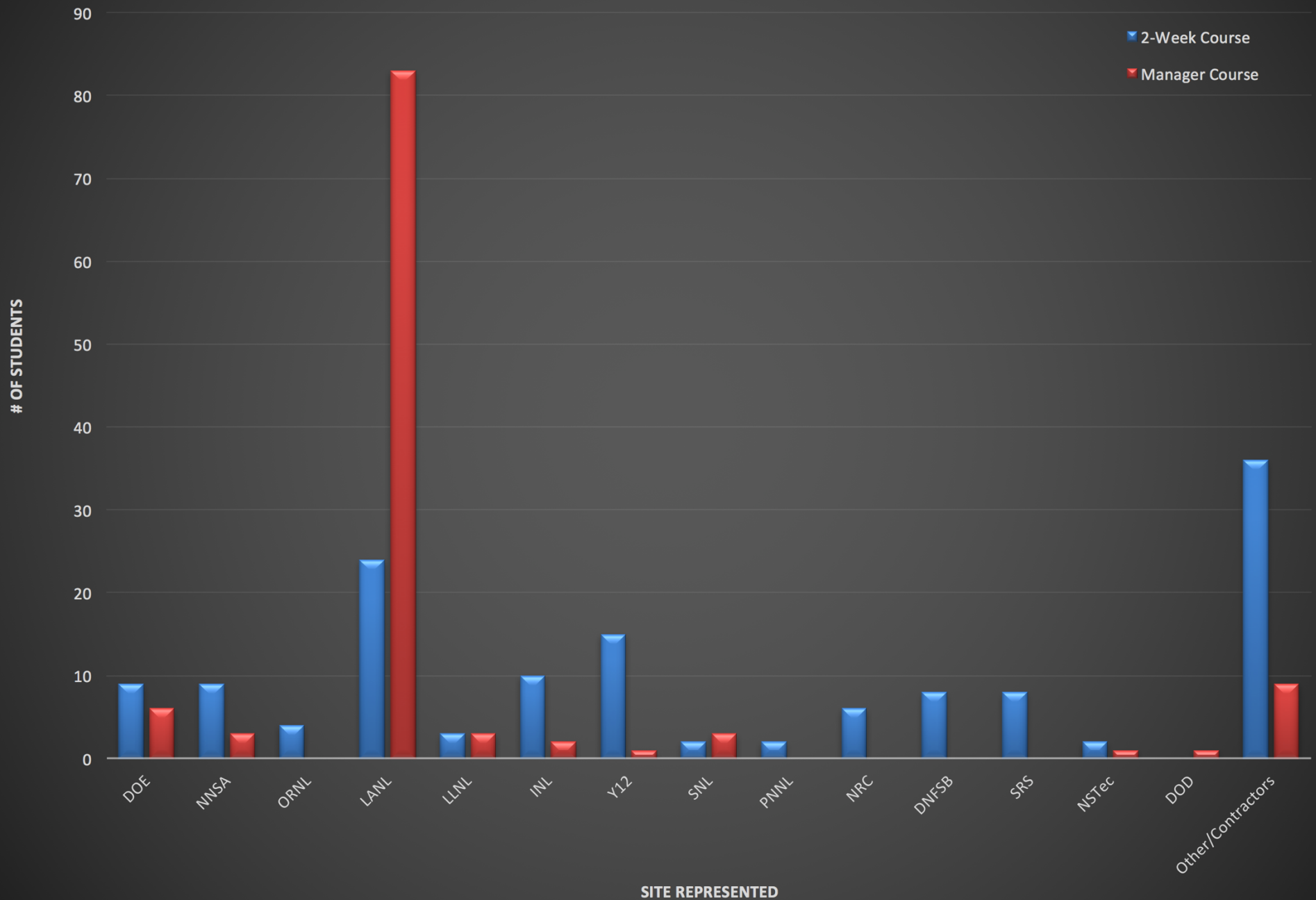
NCSP T&E Courses – Timeline



NCSP Training and Education Project Course Attendance by FY



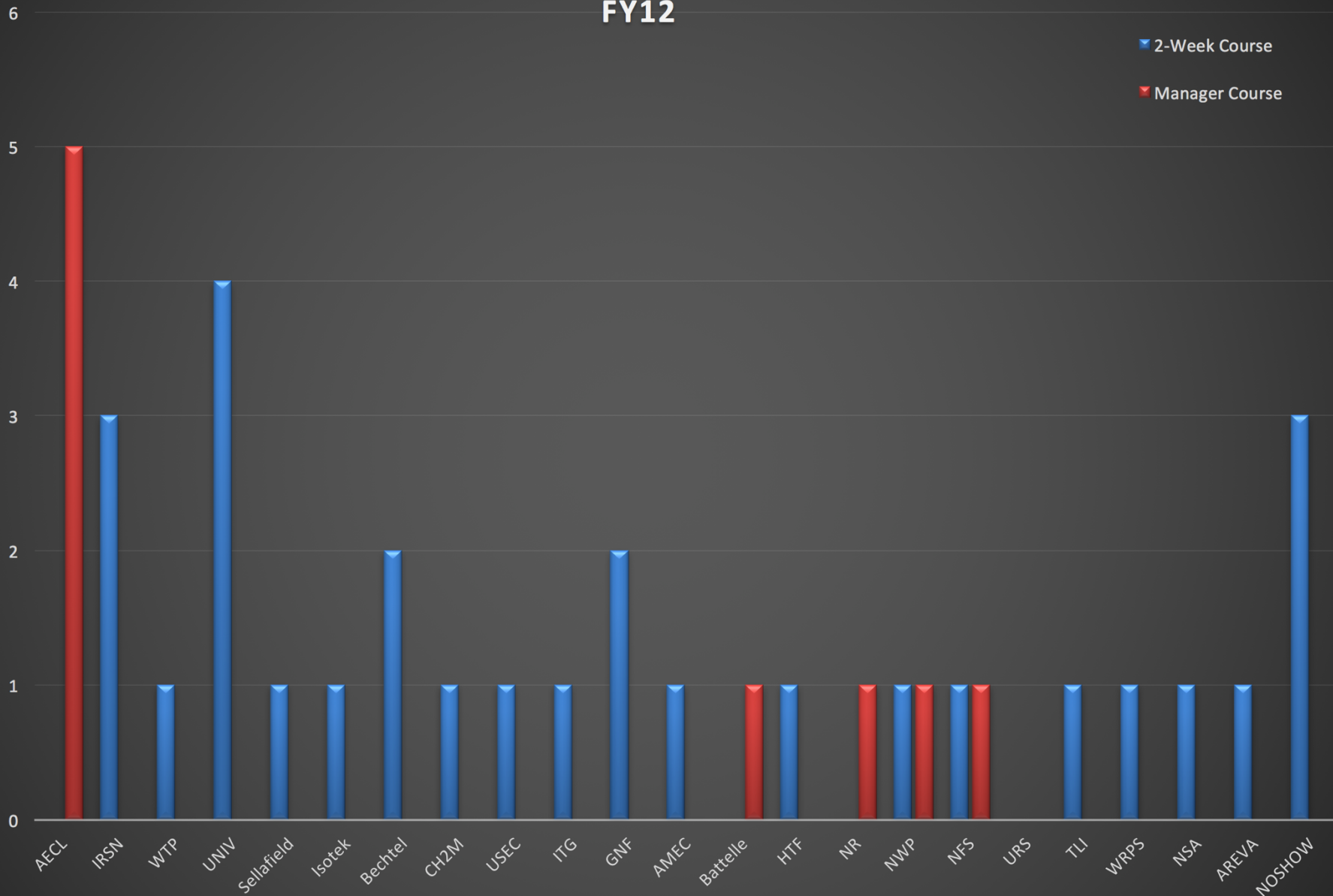
NCSP Training and Education Project Course Attendance



NCSP T&E Project Course Attendance – Others/Contractors – Since FY12

OF STUDENTS

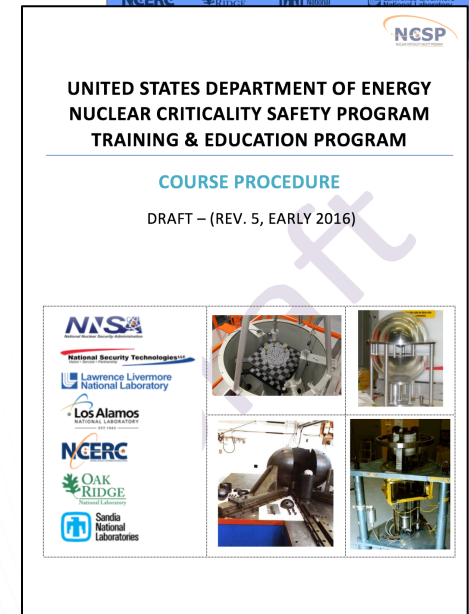
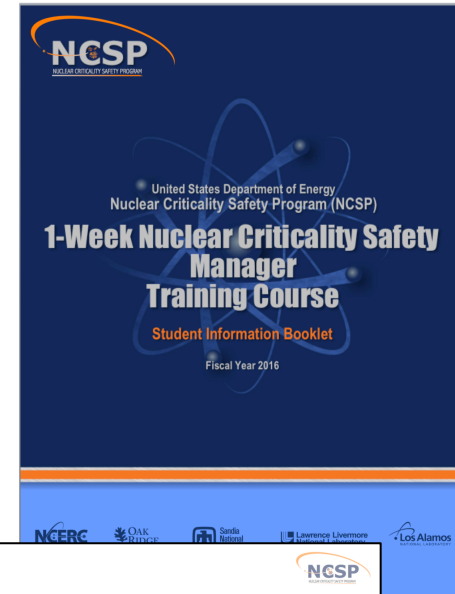
2-Week Course
Manager Course



SITE REPRESENTED

Logistical Improvements and Future Course Updates

- Logistical upgrades based on student feedback
 - NCSP T&E registration page has been simplified
 - Course syllabi, travel information, and other information was combined into a Student Information Booklet for both courses
 - Course Procedure has been drafted to outline roles and responsibilities, registration, logistics, module development, etc.
- Course telecons have been reduced in frequency and involve only needed staff rather than the entire T&E team
- Future course updates (modules, agenda, etc.) will occur on an annual cycle at the end of each fiscal year rather than an on-going basis
 - The goal is to achieve a near steady state condition with the courses



**Are there any
questions?**